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JERRY.SHORMA@HP.COM  
ipa.mail@hp.com  
jessica.l.fusek@hp.com

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* ALAN R. ARTHUR, GARY TARVER, and DANIEL A. KEARL

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Appeal 2009-002860  
Application 10/686,896  
Technology Center 1700

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Decided: August 27, 2009

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Before JEFFREY T. SMITH, KAREN M. HASTINGS, and  
JEFFREY B. ROBERTSON, *Administrative Patent Judges*.

ROBERTSON, *Administrative Patent Judge*.

DECISION ON APPEAL

## STATEMENT OF THE CASE

Appellants appeal under 35 U.S.C. § 134(a) from the Examiner's rejection of claims 1-7, 9-24, 29-38, and 61-65.<sup>1</sup> (Appeal Brief filed April 23, 2008, hereinafter "App. Br.," 4). We have jurisdiction pursuant to 35 U.S.C. § 6(b).

We AFFIRM-IN-PART.

## THE INVENTION

Appellants describe a multi-cell fuel cell layer that includes a fuel flow channel defined in a first, anode side of a substrate, and a cathode air flow channel defined in a second and opposite, cathode side of the substrate. Claims 1, 4, 12, 13, 16, and 29, reproduced below, are representative of the subject matter on appeal.

1. A multi-cell fuel cell layer, comprising:  
a substrate;

an array of fuel cells each having an anode, a cathode, and an electrolyte disposed on said substrate;

conductors electrically coupled to said fuel cell array;

a fuel flow channel defined in a first, anode side of said substrate; and

a cathode air flow channel defined in a second and opposite, cathode side of said substrate.

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<sup>1</sup> Claims 39-60 have been canceled and claims 8 and 25-28 have been indicated as containing allowable subject matter. (Examiner's Answer mailed July 10, 2008, hereinafter "Ans.," 2).

4. The fuel cell layer of claim 2, further comprising a cathode air inlet and an excess cathode air outlet defined in said substrate.
12. The fuel cell layer of claim 1, wherein said electrolyte seals non-active portions of said substrate.
13. The fuel cell layer of claim 1, further comprising flow modification features associated with either or both of said fuel flow channel and said cathode air flow channel, said flow modification features being configured to distribute a flow of fuel or air emerging from an inlet across a width of said fuel flow channel or said air flow channel, respectively.
16. A fuel cell system, comprising:  
a plurality of fuel cell layers each including an array of fuel cells each having an anode, a cathode, an electrolyte and conductors disposed on a substrate, a fuel flow channel defined in an anode side of said substrate, and a cathode air flow channel defined in an opposite, cathode side of said substrate,  
wherein said fuel cell layers are alternating stacked.
29. The system of claim 16, wherein said fuel flow channels or air flow channels comprise ports that can be opened or closed to selectively activate or deactivate each individual layer of said plurality of layers.

## THE REJECTIONS

The prior art relied upon by the Examiner in rejecting the claims on appeal is:

Takayanagi	JP 08-213043	Aug. 20, 1996 <sup>2</sup>
Wilkinson	US 5,773,160	Jun. 30, 1998
Bostaph	US 2002/0076598 A1	Jun. 20, 2002

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<sup>2</sup> As translated.

Appeal 2009-002860  
Application 10/686,896

Nguyen	US 6,503,651 B1	Jan. 7, 2003
Haluzak	US 2003/0022051 A1	Jan. 30, 2003
Mook	US 2003/0235745 A1	Dec. 25, 2003 (filed Feb. 20, 2003)

There are ten grounds of rejection for review on appeal:

- (1) the Examiner rejected claims 1-5, 7, 11-14, 61, and 62 under 35 U.S.C. § 102(b) as being anticipated by Bostaph;
- (2) the Examiner rejected claim 6 under 35 U.S.C. § 103(a) as being unpatentable over Bostaph in view of Wilkinson;
- (3) the Examiner rejected claims 9, 10, and 65 under 35 U.S.C. § 103(a) as being unpatentable over Bostaph in view of Wilkinson;
- (4) the Examiner rejected claim 15 under 35 U.S.C. § 103(a) as being unpatentable over Bostaph;
- (5) the Examiner rejected claims 16, 32-34, 36, 63, and 64 under 35 U.S.C. § 103(a) as being unpatentable over Bostaph in view of Haluzak;
- (6) the Examiner rejected claims 17-24 under 35 U.S.C. § 103(a) as being unpatentable over Bostaph in view of Haluzak and Takayanagi;
- (7) the Examiner rejected claim 29 under 35 U.S.C. § 103(a) as being unpatentable over Bostaph in view of Haluzak and Nguyen;
- (8) the Examiner rejected claims 30 and 31 under 35 U.S.C. § 103(a) as being unpatentable over Bostaph in view of Haluzak and Takayanagi<sup>3</sup>;

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<sup>3</sup> Although Appellants appeal the rejection of claims 30 and 31 over the combined teachings of Bostaph, Haluzak, and Takayanagi (App. Br. 9), Appellants have not presented a separate heading with Arguments for this rejection as required by 37 C.F.R. § 41.37(c)(1)(vii).

- (9) the Examiner rejected claim 35 under 35 U.S.C. § 103(a) as being unpatentable over Bostaph in view of Haluzak and Mook; and
- (10) the Examiner rejected claims 37 and 38 under 35 U.S.C. § 103(a) as being unpatentable over Bostaph in view of Haluzak, Takayanagi, and Nguyen.

## ISSUES

The issues on appeal are:

Have Appellants shown that the Examiner reversibly erred in interpreting “a substrate” having “a fuel flow channel defined in a first, anode side” and “a cathode air flow channel defined in a second and opposite, cathode side” to include the structures of Bostaph?

Have Appellants shown that the Examiner reversibly erred in finding that the recited excess cathode air outlet in claim 4 is anticipated by current collector 28 of Bostaph?

Have Appellants shown that the Examiner reversibly erred in finding that the electrolyte in Bostaph seals non-active portions of the substrate as recited in claim 12?

Have Appellants shown that the Examiner reversibly erred in finding that Bostaph discloses the flow modification features recited in claim 13?

Have Appellants shown that the Examiner reversibly erred in determining that inlets comprising ports that can be opened and closed to selectively activate or deactivate each individual layer as recited in claim 29 would have been obvious over Bostaph in view of Haluzak and Nguyen?

## FINDINGS OF FACT

The record supports the following findings of fact (FF) by a preponderance of the evidence.

1. The Examiner stated “it is reasonable to conceive that a substrate can be formed from two separate components.” (Ans. 12).
2. The Examiner stated:  
the base portion “14” and the cap portion “27” taught by Bostaph et al, are necessarily sealed to the membrane electrode assemblies “16” in order to prevent the cathode air and fuel from mixing. Since the base portion and cap portion are sealed together during the assembly of the fuel cell device, the final component is construed as a single, integral substrate.  
(Ans. 13).

3. Figure 1 of Bostaph is reproduced below:

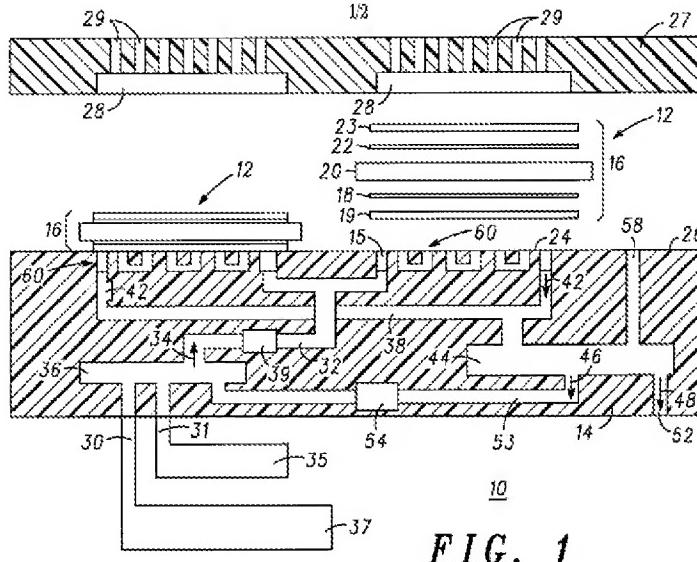


FIG. 1

Figure 1 depicts a fuel cell system 10 including base portion 14, a first fluid inlet 30, a fuel cell 12 including an anode 18, an electrolyte 20, and a cathode 22, a cap portion 27, a current collector 28, air flow-

throughs 29, and exhaust channel 38. (Paras. [0018], [0020], [0022], and [0024]).

4. Bostaph discloses that the electrolyte 20 prevents the permeation of fuel from the anode side to the cathode side of each fuel cell. (Para. [0022]).
5. Bostaph discloses that current collector 28 is part of cap portion 27 and includes a plurality of air flow-throughs 29 positioned to overlay membrane electrode assembly 16, which provides for the exposure of the cathode 22 to ambient air. (Para. [0024]).
6. Haluzak discloses a plurality of fuel cell layers that are alternatively stacked. (Para. [0040]; Fig. 5).
7. Nguyen discloses a fuel cell stack where each cell of the stack contains an individual openable and closeable valve in each of the fuel side and oxidant side outlets. (Col. 9, ll. 15-38, Figs. 5 and 6).

#### PRINCIPLES OF LAW

“A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” *Verdegaal Bros., Inc. v. Union Oil Co. of California*, 814 F.2d 628, 631-32 (Fed. Cir. 1987). Analysis of whether a claim is patentable over the prior art under 35 U.S.C. § 102 begins with a determination of the scope of the claim. We “determine [] the scope of the claims in patent applications not solely on the basis of the claim language, but upon giving claims their broadest reasonable construction ‘in light of the specification as it would be interpreted by one of ordinary skill in the art.’” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1317 (Fed. Cir. 2005) (quoting *In re Am. Acad. of Sci.*

*Tech. Ctr.*, 367 F.3d 1359, 1364 (Fed. Cir. 2004)). The properly interpreted claim must then be compared with the prior art.

Appellants have the burden on appeal to the Board to demonstrate error in the Examiner's position. *See In re Kahn*, 441 F.3d 977, 985-86 (Fed. Cir. 2006) ("On appeal to the Board, an applicant can overcome a rejection [under § 103] by showing insufficient evidence of *prima facie* obviousness or by rebutting the *prima facie* case with evidence of secondary indicia of nonobviousness.") (quoting *In re Rouffet*, 149 F.3d 1350, 1355 (Fed. Cir. 1998)).

## ANALYSIS

Appellants only present separate arguments for grounds of rejection (1), (5), and (7). Therefore, our discussion is limited to these grounds of rejection, with our comments regarding ground of rejection (1) applying equally to grounds of rejection (2)-(4) and our comments regarding ground of rejection (5) applying equally to grounds of rejection (6), and (8)-(10). Regarding ground of rejection (1), Appellants have grouped claims 1 and 61, 4 and 5, 12, and 13 and 14 separately. Accordingly, we confine our discussion to appealed claims 1, 4, 12, and 13, which contain claim limitations representative of the arguments made by Appellants for the first ground of rejection pursuant to 37 C.F.R. § 41.37(c)(1)(vii).<sup>4</sup>

### *Ground of Rejection (1)*

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<sup>4</sup> Only those arguments actually made by Appellants have been considered in this decision. Arguments which Appellants could have made but chose not to make have not been considered and are deemed to be waived. *See* 37 C.F.R. § 41.37(c)(1)(vii) (2007).

*Claim 1*

The Examiner found that Bostaph discloses: “a substrate ‘27’ & ‘14’ . . . a fuel flow channel ‘30’ defined in first anode side of the substrate; and a cathode air flow channel ‘29’ defined in a second and opposite cathode side of the substrate.” (Ans. 3-4).

Appellants contend that Bostaph discloses fuel and air channels located in different and separate substrates, whereas the present claims require a single substrate with the fuel and air channels located in opposite sides of the substrate. (App. Br. 11-13). Appellants further contend that the single integral substrate formed by joining the base 14 and cap 27 of Bostaph cannot teach or suggest the claimed substrate with cathode and anode sides on opposite sides of the substrate because the anode and cathode are contained inside the single integral substrate. (Reply Brief filed September 10, 2008, hereinafter “Rep. Br.,” 5).

We agree with the Examiner that when the cap layer and base are joined together, a single integral substrate is formed. (FF 1-2). Bostaph’s fuel flow channel 30 is on the “side” of the substrate 14 closest to anode 18 of the fuel cell, and air flow channel 29 is on the “side” of the substrate 27 closest to cathode 22 of the fuel cell, which is the opposite side of the substrate containing fuel flow channel 30. (*See* FF 3). Accordingly, Appellants’ have failed to show that the Examiner’s interpretation of the claims was unreasonable.

*Claim 12*

The Examiner found that Bostaph discloses “an electrolyte ‘20’ that seals non-active portions of the substrate.” (Ans. 4).

Appellants contend that it is unclear whether Bostaph's electrolyte 20 makes contact with the substrate so as to seal non-active portions of the substrate. (App. Br. 15).

The Examiner's position in rejecting claim 12 is that the electrolyte layer is necessarily sealed to the top and bottom portions of the substrate in order to prevent mixing of the cathode air and fuel, thus also sealing the non-active portions of the substrate. (Ans. 13-14). The Examiner's position is supported by Bostaph, which discloses that the electrolyte layer prevents permeation of fuel from the anode side to the cathode side of each fuel cell. (FF 4). Accordingly, Appellants' contention is not persuasive of reversible error.

*Claim 4*

The Examiner found that Bostaph discloses "an excess cathode air outlet '28.'" (Ans. 4).

Appellants argue that element 28 of Bostaph is not an excess cathode air outlet, but is a "current collector." (App. Br. 15).

We agree with Appellants that Bostaph's current collector 28 is not an excess cathode air outlet. Bostaph discloses that current collector 28 includes a plurality of air flow-throughs 29. (FF 5). The current collector 28 is part of cap layer 27 and provides for exposure of the cathode to ambient air through air flow-throughs 29. (FF 5). While air passes from air flow-throughs 29 through current collector 28, Bostaph fails to disclose that current collector 28 receives excess cathode air from the fuel cell. Accordingly we reverse the Examiner's rejection of claims 4 and 5, as well as ground of rejection (2) rejecting claim 6, which depends from claim 4.

*Claim 13*

The Examiner found that Bostaph discloses “flow modification features ‘66’ associated with the fuel flow channel ‘72’, wherein the flow modification features are configured to distribute a flow of fuel emerging from an inlet across the width of the fuel flow channel.” (Ans. 4-5).

Appellants contend that the ceramic layers of Bostaph having a plurality of three-dimensional microfluidic delivery channels is not a teaching of flow modification features that are configured to distribute a flow of fuel or air emerging from an inlet across the width of the fuel flow channel of air flow channel. (App. Br. 16).

We agree with Appellants that Bostaph fails to teach the recited flow modification features. The Examiner has not provided an adequate explanation as to how ceramic layer 66 acts as a flow modification feature to distribute the air emerging from an inlet across the width of fuel channel 72. Therefore, we reverse the Examiner’s decision rejecting claims 13 and 14 as being anticipated by Bostaph.

*Ground of Rejection (5)*

The Examiner found that Bostaph fails to expressly teach a plurality of fuel cell layers each including an array of fuel cells as recited in claim 16, but that Haluzak discloses “a plurality of fuel cell layers ‘40’ each including an array of fuel cells.” (Ans. 7). The Examiner determined that it would have been obvious to modify Bostaph’s fuel cell to include a plurality of fuel cell layers each including an array of fuel cells “to maximize the energy density of the fuel cell system stacking fuel cell layers.” (Ans. 8).

Appellants argue that Haluzak fails to disclose a cathode air flow channel in an opposite or cathode side of the substrate. (App. Br. 17).

We are not persuaded by Appellants' arguments that Bostaph fails to disclose the recited substrate as explained in detail, *supra*. Moreover, as pointed out by the Examiner, Haluzak is relied on for the concept of a plurality of fuel cell layers. (Ans. 14). Therefore, Appellants' arguments are not persuasive of reversible error.

*Ground of Rejection (7)*

The Examiner found that Bostaph as modified by Haluzak does not expressly teach the flow channels or air flow channels recited in claim 29. (Ans. 10). The Examiner found that Nguyen teaches a fuel cell stack including ports with valves "that can be opened or closed to selectively activate or deactivate each individual fuel cell in the fuel cell stack." (*Id.*). The Examiner determined that it would have been obvious to modify the Bostaph/Haluzak fuel system with the ports and valves of Nguyen "in order to improve the nonuniformity in flow resistance among the cells in the stack that leads to nonuniform cell-to-cell performance and non-optimal stack performance." (*Id.*).

Appellants contend that Nguyen teaches that the individual fuel cell layers may be purged of byproducts while all cells are operating, not ports that selectively activate or deactivate individual fuel cell layers. (App. Br. 19-20; Rep. Br. 14).

Appellants have provided no persuasive evidence to rebut the Examiner's rationale that the valves of Nguyen would be incapable of selectively activating or deactivating each individual layer. (*See* Ans. 14-15). Therefore, Appellants' arguments are not persuasive of reversible error.

## CONCLUSION

Appellants have failed to demonstrate that the Examiner reversibly erred in interpreting “a substrate” having “a fuel flow channel defined in a first, anode side” and “a cathode air flow channel defined in a second and opposite, cathode side” to include the structures of Bostaph. Appellants have also failed to demonstrate that the Examiner reversibly erred in finding that the electrolyte in Bostaph seals non-active portions of the substrate as recited in claim 12. Appellants have failed to demonstrate that the Examiner reversibly erred in determining that inlets comprising ports that can be opened and closed to selectively activate or deactivate each individual layer as recited in claim 29 would have been obvious over Bostaph in view of Haluzak and Nguyen.

Appellants have demonstrated that the Examiner reversibly erred in finding that the recited excess cathode air outlet in claim 4 is anticipated by current collector 28 of Bostaph. Appellants have demonstrated that the Examiner reversibly erred in finding that Bostaph discloses the flow modification features recited in claim 13.

## ORDER

We affirm the Examiner’s rejections of claims 1-3, 7, 9-12, 15-24, 29-38, and 61-65 and reverse the Examiner’s rejection of claims 4-6, 13, and 14.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. §1.136(a)(1)(v).

AFFIRMED-IN PART

Appeal 2009-002860  
Application 10/686,896

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sld

HEWLITT-PACKARD COMPANY  
INTELLECTUAL PROPERTY ADMINISTRATION  
3404 E. HARMONY ROAD  
MAIL STOP 35  
FORT COLLINS, CO 80528